A.H.P.

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SCHIZONOTINUS, A MOST CURIOUS NEW GENUS FROM THE CAUCASUS (ORTHOPTERA, TETTIGONIIDAE).

By W. Ramme.

(*Zoological Museum, Berlin.*)

I have received from Dr. S. Y. Paramonov a number of Orthoptera from the Krasnodar province of Northern Caucasus, including a highly remarkable new Tettigoniid. While the female has an appearance somewhat like a *Pholidoptera*, the male has an extraordinarily long and narrow abdomen, with square or rectangular tergites (fig. 1). Since there were three quite similar males, there could be no suspicion of a deformation due to preparation. All three males

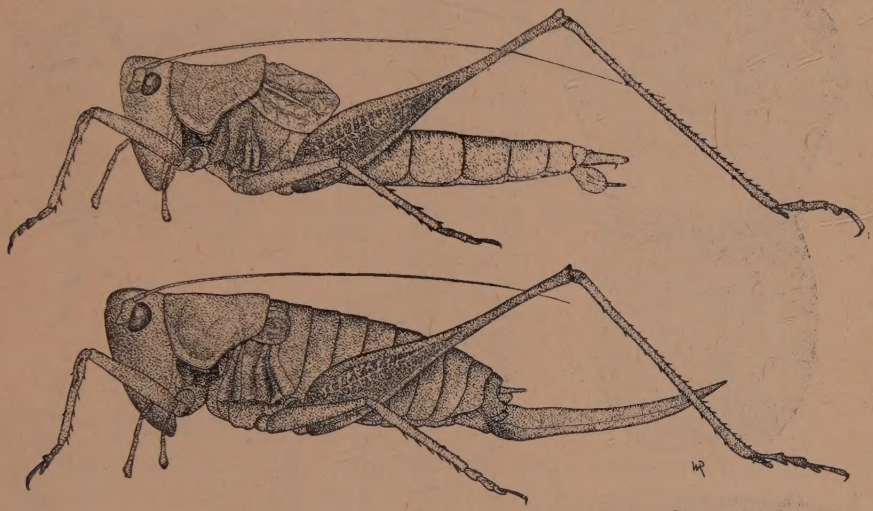

Fig. 1.—*Schizonotinus caucasicus* gen. et sp. n., ♂ and ♀.

show a strong fold of the integument, extending along the middle of abdomen. After relaxing it was seen that the integument of the 6th–9th tergites was transformed in the middle to soft skin, so that a narrow groove, widened behind, was formed (fig. 2*b*). The two anterior tergites have only a narrow ridge, obviously of softer chitin; the last tergite shows only a narrow groove. As a result of shrinkage during drying, the inner margins of the groove came close together. In the female there is no such modification of the tergites. The description of the new genus follows.

Schizonotinus gen. n.

Fastigium of vertex broad, above somewhat globular; its greatest width about four times that of the first antennal segment; separated from the frons only by a fine, nearly convex furrow; sides with acute, somewhat projecting and anteriorly convergent edges. The angle between vertex and face in ♂ almost right, in ♀ obtuse, rounded. Eyes small, globular, anterior margin oblique, lower angle somewhat acute.

Mesosternal lobes acute, but with the immediate apices somewhat blunted, separated by a rather broad interval, directed obliquely backwards. Metasternal lobes shorter, apically rectangular, broadly separated and directed obliquely backwards.

Anterior coxa with a broad curved spine. Anterior femur about as long as pronotum dorsally; middle femur longer by one fifth; posterior femur and tibia rather long and slender. All femora unarmed. Anterior tibia with 3 upper external spines; its lower external and internal edges each with 6 spines; middle tibia with 4–5 upper internal and 2 upper external spines; its lower edge with 5 internal and 6 external spines in the ♂, while the female has 5–6 spines on both sides; hind tibia with 20–24 spines internally and externally. Posterior tarsus with movable, elongate-oval, rounded behind, pulvilli, which are half as long as the first tarsal segment.

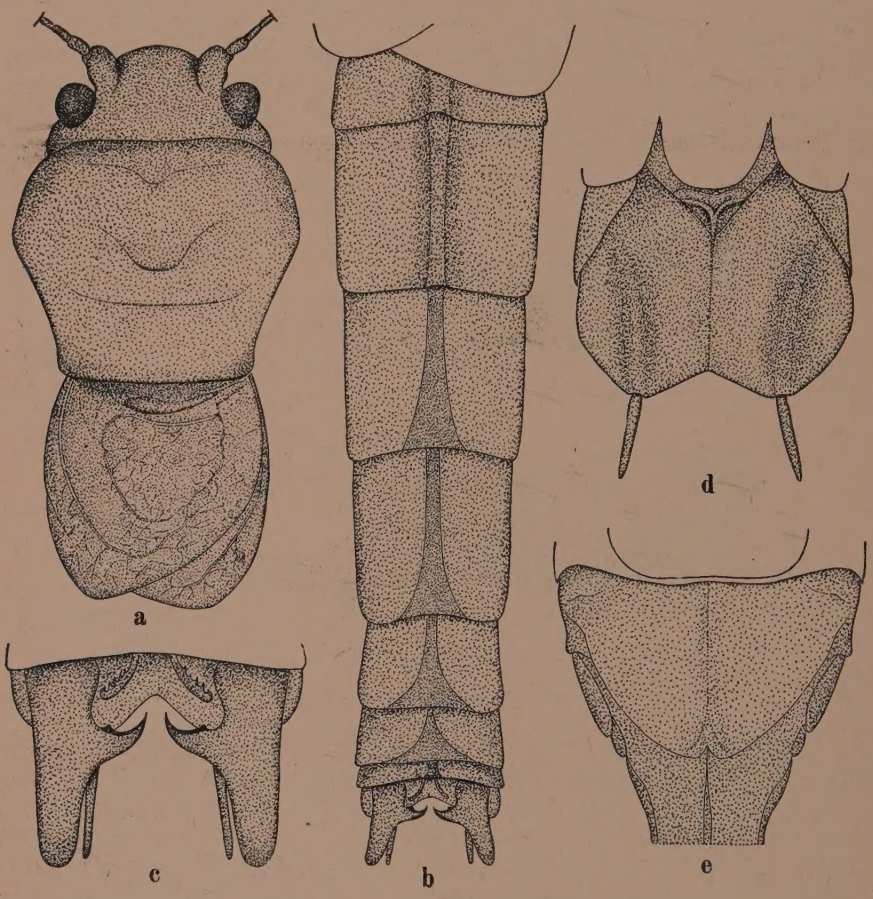

Fig. 2.—*Schizonotinus caucasicus* gen. et sp. n. *a*, Head, pronotum and elytra, ♂; *b*, abdomen, ♂; *c*, end of male abdomen, dorsal view; *d*, male subgenital plate, ventral view; *e*, female subgenital plate, ventral view.

♂. Pronotum short, flat, weakly saddle-shaped; lateral lobes almost vertical; edges somewhat diverging posteriorly, more pronounced in metazona. Anterior transverse furrow weak, bent backwards; middle furrow broadly V-shaped, interrupted in the middle; it is placed midway between the weakly concave anterior margin and the almost straight posterior; posterior furrow with the posterior margin very weakly swollen; metazona finely punctured; prozona rather smooth, with a very fine median line. Anterior lower margin of lateral lobe weakly obliquely ascending, about one-third again as long as the weakly concave posterior margin and forming with the latter an almost right, but rounded,

angle. Between the posterior margin of the lateral lobe and its upper edge there is an elongate curved depression.

Elytra projecting somewhat beyond the 3rd tergite, as broad as the hind margin of pronotum ; vena plicata close to the latter. Elytral disc approximately square, the sides weakly convergent backwards, surface weakly rugulose.

Abdomen extremely long and narrow ; tergites 4–6 rectangular or square ; the first five tergites with a weak median carina ; tergites 6–9 with median furrows, which are widened behind and are weakly chitinized ; 10th tergite with a narrow furrow.

Cercus stout ; apex broadly rounded ; before the middle there is an acute inner tooth with broad base and a chitinous ridge along its anterior edge ; the ridge bears a tubercle basally. Subgenital plate broad, with obtusely angulate excision ; lateral lobes broad, rounded ; underside with a median carina (probably more pronounced in dry specimens), and with lateral ridges leading to the bases of the styli, which are very slender ; base of the plate with acutely angulate excision, the sides of which are swollen. The whole genital region is finely hairy. Titillators (fig. 2*c*) fine, somewhat curved, armed with 5–6 denticles.

♀. Abdominal tergites normal in their proportions, not furrowed. Pronotum not saddle-shaped ; its edges more rounded. Elytra lateral, lobiform, broadly rounded. Ovipositor shorter than abdomen, weakly recurved. Subgenital plate broadly heart-shaped, weakly incised.

Schizonotinus caucasicus sp. n.

Uniformly light brown of light olivaceous shade. Pronotum above somewhat darker ; lower edge of the lobes a little lighter.

	♂.	♀.
Body	23 .	20–20·5
Abdomen . . .	14·5 .	14–14·5
Pronotum . . .	4·5–4·6 .	5·2–5·4
Post-femur . . .	18·2–19 .	19–20
Post-tibiae . . .	16·9–18 .	18·2
Ovipositor . . .	.. .	13–14

Type ♂, allotype ♀, 2 ♂ and 6 ♀ paratypes. Northern Caucasus, Mt. Airga, 3000 m., near Krasnaya Polyana, on the eastern side of the river Mzymta ; on alpine and subalpine meadows (*S. Y. Paramonov*).

A similar case of such extreme morphological sexual dimorphism is not known to me in the whole Order of Orthoptera, and only after a prolonged search I have found a somewhat analogous case of splitting of tergites. In *Psorodonotus venosus* (F.-W.) the tergites 7, 8 and 9 in the male are similarly split in the middle and the side pieces connected by soft cuticle ; only the furrows are widened anteriorly (fig. 3) ; in dry specimens the shrinkage leads to the formation of folds along the middle of the tergites. Similar structures are found in the closely related *P. brunneri* Stschelk.[1] ; in *P. fieberi* (F.-W.), *illyricus* Ebner and *caucasicus* (F.-W.) there are indications of this structure in the shape of a narrow median line which appears to have softer cuticle, whereas this is not the case in *P. specularis* (F.-W.), *P. inflatus* Uv., and in a new species which is to be described later.

In some analogy to *Schizonotinus* all species of *Psorodonotus* have the male abdomen relatively more narrow compared with the female than in other Decticinae ; the cuticle of the ♂ abdomen is also softer, as can be felt in live insects, and as is shown by the tendency to shrink on drying. Both genera have in common, and in distinction from, e.g., *Pholidoptera* and *Metrioptera*, small round eyes, and inflated and somewhat rugose elytra. On the other

[1] In a revision which will appear later this is recognized as a good species.

hand, the pronotum of *Psorodonotus* is strongly extended behind and differs from the short pronotum of *Schizonotinus*, but this character is of little taxonomic value, as is seen in *Pholidoptera* (the *schmidti* or *signata* groups as against *aptera* and *frivaldskyi*). Both genera are also of common Caucasian origin, since it is beyond doubt (as already indicated by Stschelkanowtzev and Ebner) that Caucasus is the distribution centre of *Psorodonotus*, as only two out of its seven species occur elsewhere. Both genera live in the meadows of subalpine and alpine regions.

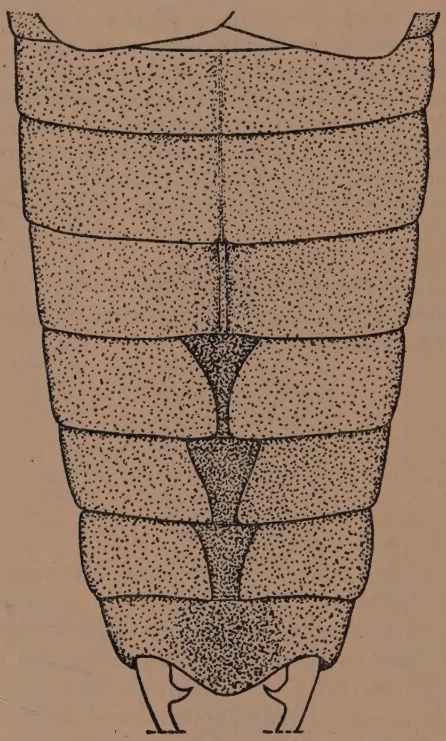

FIG. 3.—*Psorodonotus venosus* (F.-W.). Male abdomen.

The genus *Psorodonotus* is also undoubtedly close to EPHIPPIGERINAE, particularly to *Ephippigera*, having in common with it the soft cuticle, inflated and rugose elytra of the male, and small eyes. The transformation of the female elytra into stridulating organs in EPHIPPIGERINAE is quite aberrant. The quiet behaviour of *Psorodonotus*, with little inclination to jump, as opposed to the wild and wary DECTICINAE, also makes it closer to EPHIPPIGERINAE, which show a very sluggish behaviour. I should suppose the same for *Schizonotinus*, since most of the high mountain TETTIGONIIDAE behave in the same manner.

On the whole, *Psorodonotus* and *Schizonotinus* are not typical DECTICINAE, and there is a possibility that they represent remnants of formerly more extensive subfamilies of TETTIGONIIDAE. For the present I would abstain from establishing new subfamilies, each represented by a single genus, and they may be left at the end of DECTICINAE.

ON THE CURCULIONID GENUS *SPARTECERUS* SCHÖNHERR (COL.).

By Sir Guy A. K. Marshall, K.C.M.G., F.R.S.

By an unfortunate oversight the weevil genus *Spartecerus*, which is peculiar to Africa, has been entirely omitted from the *Catalogus Coleopterorum*. While compiling a list of the species as a supplement to the Catalogue it seemed desirable to attempt a revision of this difficult group, so as to bring the known species up to date, and this has been rendered possible by the kind help of Dr. R. Malaise, of the Stockholm Museum, and Dr. A. J. Hesse, of the South African Museum, who readily sent me typical material from their respective collections.

The genus belongs to the subfamily Leptopinae, which is poorly represented in continental Africa, the only other genera occurring there being *Leptostethus* Waterh. (2 species), *Enicoderus* Pér. (4 species) and *Timus* Pér. (3 species), all of which are confined to the semi-arid areas of South-West Africa. In the Catalogue *Orimus* Schönh. and *Aporimus* Mshl. are also included in this subfamily, but these should now be transferred to the Eremninae, tribe Eremnini.

In the Munich Catalogue (1871) six species of *Spartecerus* are recorded, but of these, three do not belong to the genus or to the subfamily :

(1) *S. capucinus* Gerst., judging by the description, belongs undoubtedly to the genus *Hoplitotrachelus* Schönh. (Byrsopinae), and will probably prove to be one of the species described later by Kolbe from East Africa.

(2) *S. foedus* Boh. certainly belongs to the genus *Dyerocera* Pasc., various species of which are at present included in *Brachycerus* Oliv.

(3) *S. sellatus* Klug, from Principe I., Gulf of Guinea, is clearly a species of *Synthocus* Schönh. (Brotheinae), and is possibly synonymous with *S. truncatus* Boh., which is widely distributed on the mainland.

In all, 19 species of *Spartecerus* have been described, but two of these (*bifasciatus* Pér. and *infaustus* Pasc.) fall in synonymy, and two new species are described below, so that the number remains at 19.

The following is an alphabetical list of the species to supplement the Catalogue :

angulatus Gyllenhal, 1834, *Schönh. Gen. Curc.* **2** : 422 (genotype).
aureolus Hustache, 1938, *Bull. Soc. Neuchât. Sci. nat.* **62** : 72.
brevipennis Fåhraeus, 1871, *Öfv. K. Vet. Ak. Förh.* : **1871** : 201.
confragosus Hesse, 1929, *Ann. S. Afr. Mus.* **25** : 508.
depressus Fåhraeus, *l.c.* : 201.
guasonicus Aurivillius, 1913, *Ark. Zool.* **8**, no. 21 : 5.
humeralis Péringuey, 1888, *Trans. S. Afr. Phil. Soc.* **1888** : 167.
hypocrita Fåhraeus *l.c.* : 199.
mendax Péringuey, *l.c.* : 168.
milleri Marshall, sp. n. (*infra*).

nasalis Marshall, 1926, *Ann. Natal Mus.* **5** : 243.
obesus Boheman, 1842, *Schönh. Gen. Curc.* **6**, 2 : 439.
pallidus Hesse, *l.c.* : 510.
quadratus Gerstaecker, 1855, *Monatsb. Berl. Ac.* : 84 ; 1862, Peters' *Reise Mossamb.* : 309, pl. xviii, f. 10.
bifasciatus Péringuey, *l.c.* : 167 **(n. syn.)**.
rudis Fåhraeus, *l.c.* : 199.
infaustus Pascoe, 1887, *Trans. ent. Soc. Lond.* **1887** : 338, pl. xi, f. 12.
simulator Hesse, *l.c.* : 512.
sculptilis Marshall, sp. n. (*infra*).
trisulcatus Hartmann, 1906, *Deut. ent. Zeits.* **1906** : 71.
umbrinus Fåhraeus, *l.c.* : 200.

The species of *Spartecerus* seem to flourish best in relatively dry and more or less open country, and the largest number of species has been recorded from the comparatively little-known area of South-West Africa, namely, 7 ; Bechuanaland and Griqualand West have yielded 5 ; south-eastern Cape Province 3 ; Orange Free State 5 ; Transvaal and Natal 4 ; Portuguese East Africa 1 ; Southern Rhodesia 3 ; Angola 2 ; Northern Rhodesia 1 ; Nyasaland 1 ; Tanganyika 2 ; and Kenya 1.

They are terrestrial insects, but nothing has been recorded regarding their food-plants or life-histories. On the eastern side of Southern Africa they have been found crawling on the ground after rain and under stones during the dry season. The species occurring in the areas of very low rainfall or winter rains (very roughly, west of 26° E. long.) are not found on the eastern side, an *vice versa*, with the single exception of *rudis* Fhs., which ranges from Natal and the Transvaal to South-West Africa.

Specimens of all the species have been examined with the exception of *aureolus* Hust. from Angola. Owing to the unfortunately prolonged illness of Mr. A. Hustache away from his home, it has been impossible for him to lend me the unique type of his species, which cannot be included in the following key on the basis of the description only.

Key to the Species of Spartecerus.

1 (6). Frons smooth and convex except for a small elevation above each eye ; mesosternum with a small median tubercle ; underside of tarsi with the setae generally distributed.
2 (3). Rostrum less inflated dorsally at base ; frons sinuate in the middle of the front margin ; prothorax broader than long, more rounded laterally ; elytra truncate at base (Natal to S.W. Africa) *rudis* Fhs.
3 (2). Rostrum more inflated dorsally ; frons not sinuate in front ; prothorax as long as broad, less rounded laterally ; elytra broadly sinuate at base.
4 (5). Rostrum with the dorso-lateral margin broadly interrupted above the antennae ; elytra with intervals 3 and 5 not higher than the others, without a humeral tubercle (S.W. Africa) . . . *nasalis* Mshl.
5 (4). Rostrum not interrupted laterally ; elytra with intervals 3 and 5 higher than the others and with a distinct humeral tubercle (S.W. Africa) . . . . . *confragosus* Hesse.
6 (1). Frons tuberculate or foveate ; mesosternum without a tubercle ; underside of tarsi with a median strip devoid of setae.

7 (14). Elytra with three large tubercles forming an equilateral triangle at the top of the declivity, two on interval 5 and one between them on interval 3.

8 (9). Frons with agglomerated tubercles on each side ; epistome horizontal, with a narrow acute angle extending behind the apices of the scrobes ; pronotum with a definite median sulcus that is normally paler than the disk and often conspicuously whitish (Natal to S. Rhodesia) . . . . . *hypocrita* Fhs.

9 (8). Frons with a depression on each side, without agglomerated tubercles ; epistome vertical or subvertical, not extending behind the scrobes ; pronotum without a definite median sulcus.

10 (11). Elytra with the large tubercle on interval 3 as near to that on the other elytron as to the anterior large tubercle on interval 5 ; rostrum with the two dorsal carinae obsolescent, hind margin of epistome acute-angled, genae of ♂ not explanate (Tanganyika) *milleri* sp.n.

11 (10). Elytra with the large tubercle on interval 3 more remote from that on the other elytron than from that on 5 ; rostrum with the two carinae prominent.

12 (13). Rostrum with the hind margin of the epistome acuminate, the genae of ♂ explanate ; elytra with a rather large tubercle at the apex of interval 3, the suture without tubercles on the declivity (Portuguese E. Africa) . . . . . *trisulcatus* Hartm.

13 (12). Rostrum with the hind margin of the epistome broadly rounded, the genae of ♂ not explanate ; elytra with no definite tubercle at the apex of interval 3 ; the suture with a row of small tubercles on the declivity (Kenya, Tanganyika) . . . . . *guasonicus* Aur.

14 (7). Elytra without such tubercles.

15 (16). Basal angles of the elytra with a tubercle projecting forwards on each side of the prothorax (S.W. Africa, Bechuanaland) *humeralis* Pér.

16 (15). Basal angles of elytra not projecting thus.

17 (26). Elytra with a horizontal subrectangular prominence at the top of the declivity and overhanging it (as in *angulatus* Boh.).

18 (23). Prothorax with a projecting lateral tubercle.

19 (22). Dorsal area of rostrum with the sides straight ; frons with a very broad deep curved depression on each side, which is much wider than the ridge above the eye ; elytra with the short costa at the base of interval 3 not higher than that on 5.

20 (21). Frons with the supra-ocular ridge much lower than the discal horseshoe-like ridge, the sides of which are complete ; prothorax with the sides of the median sulcus parallel at the base ; tibiae with a dark median spot (Cape Province) . . . . *angulatus* Boh.

21 (20). Frons with the supra-ocular ridge as high as the discal one, the sides of which are interrupted in front ; prothorax with the sides of the median sulcus divergent at the base ; tibiae uniformly grey (Orange Free State) . . . . . *depressus* Fhs.

22 (19). Dorsal area of rostrum dilated above the antennae ; frons with a deep straight sulcus on each side which is narrower than the supra-ocular ridge ; elytra with the costa at the base of interval 3 higher than that on 5 (N. Transvaal) . . . . . *sculptilis* sp. n.

23 (18). Lateral dilatation of prothorax rounded or truncate.

24 (25). Rostrum without a median carina ; elytra with a prominence near the base of interval 8 which projects laterally beyond the humeral angle on 7 (S.W. Africa) . . . . . *simulator* Hesse

25 (24). Rostrum with a median carina ; elytra with the humeral angle on interval 7 projecting well beyond the prominence on 8 (O.F.S. and Transvaal to Zambezi) . . . . . *quadratus* Gerst.

26 (17). Elytra without such a prominence ; interval 5 at most with a simple tubercle on the declivity.

27 (34). Rostrum without a median carina ; elytra with interval 5 strongly sinuate at one-third from the base.

28 (33). Frons with agglomerated tubercles on each side ; pronotum with a complete median sulcus.

29 (30). Frons with the eyebrows higher than the depth of an eye, slightly overhanging outwardly, extending far in front of the eye and there abruptly vertical (E. Cape Province) . . . . . *obesus* Boh.

30 (29). Frons with the eyebrows lower than an eye, vertical externally, extending much less in front of the eye and there gradually declivous.

31 (32). Elytra a little broader than long ; eyebrows as high as the agglomerated tubercles adjoining them ; costa at base of interval 3 on the elytra a little narrower than the base of the median pale stripe on the pronotum (Griqualand West) . . . . *brevipennis* Fhs.

32 (31). Elytra a little longer than broad ; eyebrows slightly lower than the adjoining tubercles ; costa at base of interval 3 much wider than the median pale stripe on the pronotum (O.F.S., Kimberley, S. Rhodesia) . . . . . *umbrinus* Fhs.

33 (28). Frons with two large foveae on each side, one behind the other ; pronotum without any definite median sulcus (S.W. Africa to N. Rhodesia) . . . . . *pallidus* Hesse.

34 (27). Rostrum with a median carina ; frons with a single large fovea on each side ; pronotum with a complete median sulcus ; elytra with interval 5 quite straight (Cape Prov., S.W. Africa) *mendax* Pér.

Sparteceras milleri sp.n.

♂♀. Derm black, with dense brown scaling.

Head with a depression on each side adjoining the supra-ocular ridge and a low obtuse elevation in the middle ; eyebrow lower than the short diameter of the eye, subvertical behind (in lateral view), gradually sloping in front. *Rostrum* separated from the head by an irregular transverse sulcus (sometimes containing a shallow median fovea), widened apically, but the genae not explanate in ♂ ; dorsal area parallel-sided from the base to the antennae, then slightly narrowed, the dorsal carinae comparatively low and irregular ; epistome vertical or subvertical, its hind margin acuminate and not extending behind the apices of the scrobes. *Prothorax* about as long as broad, tuberculately rounded laterally, widest in front of the middle, deeply constricted near the apex, which is a little narrower than the base, the median lobe of the apical margin gently rounded and without a fringe of scales ; dorsum with irregular variable tubercles, without any median sulcus, but with a transverse depression near the apex and an oblique sulcus on each side behind the middle. *Elytra* sub-oblong, longer than the median width, shallowly sinuate at the base, the shoulders produced laterally into a conical tubercle, approximately parallel-sided from there to the declivity, the sides tuberculate, the apical area vertical and not produced backwards ; dorsum rather irregularly foveate, interval 3 with a short obtuse costa at the base and a large obtuse conical tubercle at the top of the declivity ; interval 5 with a row of low confluent tubercles (with the usual strong sinuation at about one-third from the base), and two large obtuse conical tubercles behind, one in front of and the other behind the similar tubercle on 3, so as to form approximately an equilateral triangle, the tubercle on 3 being equally far from these as it is from the equivalent tubercle on interval 3 on the

other elytron ; interval 7 with a row of numerous conical tubercles ; on the declivity the suture is raised and without tubercles. *Legs* brown, sometimes with a pale band on the hind femora.

Length.—7·5–9·0 mm., breadth 4·0–4·5 mm.

TANGANYIKA : Usangu Dist., 3500–4500 ft., 1 ♂ 1 ♀, xii.1910 (*Dr. S. A. Neave*) : Kizumbi, 1 ♂ (type) 1 ♀, xi.1925 (*N. C. E. Miller*).

Spartecerus sculptilis sp.n.

♂. Derm black, with dense dark grey scaling above and paler grey beneath ; elytra with two faint darker bands, similar to those in *S. angulatus* Boh.

Head with the frons tumid, with a deep narrow subtriangular incision on each side from the base to above the middle of the eye, much narrower and shorter than the corresponding broad curved sulcus in *angulatus*, and between these a broad horseshoe-shaped excavation, behind which is a short deep narrow median sulcus ; the supra-ocular ridge in lateral view rounded dorsally and about twice as high as the short diameter of the eye, which is rather narrower than usual. *Rostrum* separated from the frons by a broad depression containing a transverse row of four large deep foveae separated by narrow carinae, broadly dilated anteriorly, the explanate genae having a lateral sinuation ; dorsal area widening from the base to the antennae and narrowing again in front, with a broad shallow median sulcus, which is subinterrupted between the antennae, but not enclosed in front and with a faint median carina ; epistome short, with the hind margin broadly rounded. *Prothorax* transverse, with a broad lateral projection in front of the middle formed of two connate tubercles of the same length, the front one obtuse, the hind one subacute, the sides behind it undulant ; broadly constricted at the base, deeply constricted near the apex, which is a little broader than the base, the projecting median area of the front margin broadly truncate and with a recumbent fringe of dense grey scales ; dorsum with numerous irregular small subconfluent tubercles and a broad deep median sulcus, a higher rounded agglomeration of tubercles on each side behind the middle and a large subovate fovea on each side of the median sulcus near the apex. *Elytra* subquadrate, a little longer than broad, shallowly sinuate at the base, the shoulders produced laterally into a short sharp angle, slightly narrowing from there to the declivity, the sides straight to beyond the middle, the apical area not vertical but shortly triangularly produced (as seen from above), the apices shortly separated ; dorsum sculptured much as in *angulatus* but less uneven, being thus more like that of *depressus* Fhs., almost flat in the basal half as far as interval 5, with a transverse depression at one-third from the base between intervals 1 and 5, which widens externally, followed by a common W-shaped ridge behind which the surface is somewhat lower ; interval 5 costate throughout, ending in a broad rectangular prominence (as in *angulatus*) overhanging the declivity, its inner edge extending obliquely backwards to the suture ; interval 3 hardly costate, but with a short broad elevation at the base which is higher than that on interval 5 ; interval 7 smooth, neither costate nor tuberculate ; the declivity without tubercles, but the suture rather strongly raised. *Legs* grey, hind femora brownish with a pale subapical band, hind tibiae with a faint median dark patch.

Length 9 mm., breadth 4·5 mm.

N. TRANSVAAL : 1 ♂ (*Torrance*).

MORE ALTERNATING GENERATIONS IN CYNIPIDAE (HYM.).

By M. Niblett, F.R.E.S.

In the Cynipidae the phenomenon known as alternating generations, where a sexual generation alternates with an agamic one, is confined with one exception, so far as is known, to those species whose host-plant is the Oak (*Quercus*). All are gall-causing species. In 1875 Dr. Herman Adler, of Schleswig (Adler and Stratton, 1894) commenced a series of experiments in which he sleeved various species of these insects upon young oaks, and definitely demonstrated that this alternating of generations was a fact. He also proved that certain species did not have an alternate generation, but reproduced parthenogenetically by one agamic generation only.

Dr. M. W. Beyerinck (1882), of Amsterdam, confirmed some of Adler's experiments, and also discovered some new facts. Some of Beyerinck's later claims appear to be rather doubtful, and until they are confirmed by further experiments should, I think, be accepted with considerable diffidence.

Several species occurring in Europe have been recorded from time to time as alternates of each other, as have some in North America. There is still much experimental work to be done in this group of insects. There are a number of species occurring in Britain, both of the sexual and agamic generations, where no definite proof of their connection existed, although several had been linked up apparently by supposition. For a number of years I have been working on these, and have succeeded in proving experimentally the connection between several species.

Andricus glandulae Schenck, a.g., and form *xanthopsis* Schlechtendal, s.g.

My first attempt was in 1933, with *xanthopsis*. The weather, however, became very wet and all the insects were drowned in the sleeve. Having another series of these insects emerging and as it continued wet I released them unconfined, and in July nine galls of *glandulae* were seen, undoubtedly caused by the *xanthopsis* flies released in the previous May. The releasing of these insects unconfined is not a practice I usually follow, and one I do not recommend. To obtain more definite proof I sleeved more *xanthopsis* in 1934, 1935 and 1937, but without any results. In 1938 I sleeved another series, from which fifteen *glandulae* galls resulted.

Andricus solitarius Fonscolombe, a.g., and form *occultus* Tscheck, s.g.

In 1944 a number of *occultus* were sleeved on a branch of *Quercus sessiliflora* Salisbury in my garden. On 25th June one gall of *solitarius* was found, thus linking two more forms. In 1946 another series of *occultus* was sleeved, and on 14th June four *solitarius* galls were found to have developed.

Cynips longiventris Hartig, a.g., and form *substituta* Kinsey, s.g.

Adler linked *longiventris* with *substituta* by sleeving *longiventris*. I have confirmed this connection by obtaining in 1947 galls of *longiventris* from sleeved *substituta*.

Cynips divisa Hartig, a.g., and form *verrucosa* Schlechtendal, s.g.

Adler linked *divisa* with *verrucosa* by sleeving *divisa*. I confirmed the connection in 1947 by sleeving *verrucosa* and obtaining a series of *divisa* galls as a result.

Andricus radicis Fabricius, a.g., form *trilineatus* Hartig, s.g.

All works dealing with CYNIPIDAE in speaking of galls of *trilineatus* refer to them as being embedded in the twigs and occasionally occurring on the petiole and midrib. I have been successful in obtaining galls of *trilineatus* in two successive years by sleeving *radicis*. A considerable number of galls were produced, all of which were upon leaf-stalk or midrib. Careful examination of the twigs failed to disclose any sign of a gall in them.

Cynips disticha Hartig, a.g., and its alternate form.

Hartig (1840) described *disticha* and its gall; since then apparently no alternate sexual generation has been proved to exist. I had sleeved *disticha* a number of times but they failed to produce anything.

In 1941 I commenced a systematic search for the alternate gall. One was handicapped to a certain extent by not knowing what form the gall would take, or where it would be situated. I thought it more than probable that it would take the form of one or other of the known galls of the sexual generations in the genus.

In the part of Surrey where most of my collecting and observing is done there are several small woods where *Quercus sessiliflora* is the dominant oak, and on which in the autumn it is usually possible to find at least a few galls of *disticha*. In the spring of each year I paid two visits to these woods, spending on the first visit several hours searching the adventitious buds on the trunks, and on the second visit the young leaves as they were just bursting from the buds. All my efforts had proved futile until, when paying my last visit to Selsdon Wood on 2nd May, 1946, I saw upon a partly unfolded leaf a gall which I surmised was the one I had hoped to discover. Further search resulted in the finding of another fourteen galls, all on the same tree; other trees in the vicinity were again searched, but no more galls were found.

The galls closely resembled those of *verrucosa*, but as I had never found any galls of its alternate *divisa* here, I felt convinced that I had at last discovered the alternate gall of *disticha*. Two of the galls were placed in formalin solution; from the remainder between 6.v and 11.v.46 thirteen gall wasps emerged —10 males, 3 females. Although quite certain in my own mind that I had discovered the alternate form of *disticha*, I wished to have more conclusive proof. In the autumn I collected what galls of *disticha* I could find; from them between 16.x and 8.xi.46, 13 gall wasps emerged. As they emerged they were placed in one of three sleeves on branches of a *sessiliflora* tree, and results were awaited with interest. On 2.v.47 I observed in a partly opened bud on one branch a gall similar to those previously found at Selsdon Wood, and during the following week three more galls were found. On 12.v.47 two female gall wasps emerged from the induced galls. On 5.v.47 I paid another visit to Selsdon Wood; in another area where I had previously found *disticha* galls six more galls of its alternate were found. From these on 10.v.47 one male and five female gall wasps emerged.

Having obtained the galls by sleeving *disticha*, I have no hesitation in claiming that I have definitely discovered the alternate sexual generation of *Cynips disticha*.

Cynips disticha Hartig, a.g., form **indistincta**, s.g., f.n.

Female.—Black. Head finely punctate, sparsely hairy, particularly about eyes. Antennae 14 segments, dark brown, hairy. 1st segment twice as long as wide, 2nd as long as wide, 3rd thrice as long as wide ; 1st and 2nd rather lighter in colour and less hairy than the remaining segments. Mesonotum smooth, shining ; parapsidal furrows entirely smooth with some scattered hairs along sides. Scutellum black, rugose, hairy ; foveal groove smooth, shallow, with a distinct foveal ridge. Abdomen black or black-brown, almost sessile ; hypopygial spine yellowish brown. Legs yellow, coxae, trochanters and proximal end of femur brown to black-brown. Wings, veins yellowish brown to brown, second abscissa of radius slightly triangulate at the end and not quite reaching the costal edge of wing ; discoideus with diffused brown spot at mid-point, areolet present. Length 2·5–3 mm.

Male.—Black. Antennae 15 segments. Abdomen short petiolate. Legs as in female ; there is some variation in coloration, particularly in the extent to which the browning spreads ; the fore parts of the legs in some specimens are distinctly yellow, but in the majority the yellow has a brownish tinge. Discoideus with diffused brown spot at midpoint.

Length : 2·5–2·75 mm.

Gall.—On leaves, formed before buds are fully opened. Rather variable in form, mostly cylindrical with a more or less conical tip, and base slightly constricted. Surface covered with watery vesicles, and having a few vesicular hairs ; colour grey-green to yellowish green, in fresh specimens the tip tending to a golden-yellow, thin-walled.

Length : 4–5 mm. Diameter : 2–2·3 mm.

I can find no distinctive features by which this insect can be separated from *verrucosa ;* the gall is practically identical, except in not having any red or purple tinge.

Types : 10 females, 11 males, 25 galls.

Holotype and paratype females, paratype males and galls in British Museum (Natural History). Paratype females, males and galls in my own collection.

The nomenclature used throughout is as set out by Kloet and Hincks (1946). It is unfortunate that *Cynips* has to replace *Diplolepis*, but it appears to be unavoidable. Kinsey (1929) has given what appear irrefutable reasons for this.

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A *TROX* LARVA FEEDING ON LOCUST EGGS IN SOMALIA.

By F. I. van Emden.

(*Commonwealth Institute of Entomology.*)

From the point of larval taxonomy not much can as a rule be gained from the description of isolated species in genera the larval type of which is well known, as opposed to a comparative treatment of a group of closely related species. Nor is *Trox procerus* Harold the first species of this genus found to feed on locust eggs, as *T. suberosus* Fabricius has for more than half a century been known to prey on locust eggs in the Argentine. A short comparative description of the larva is nevertheless given here at the request of Dr. B. P. Uvarov,

Fig. 1.—*Trox procerus* Harold, adult, 4 times magnified.

Director of the Anti-Locust Research Centre, in order to facilitate the recognition of these predators on locust eggs to the field workers employed in locust research and control in Africa.

The larva of *Trox suberosus* has been figured in detail and briefly described by R. J. Sim (1934, *Circ. U.S. Dept. Agr.* **334** : 11, figs. 3, 6), and by P. Denier (1936, *Mem. Com. centr. Invest. Langosta*, Buenos Aires, **1934** : 205–216), and its very considerable economic importance has been proved by K. J. Hayward (*l.c.* : 219–229). The last two authors published good photographs of all stages of the beetle (*t.c.*, pls. 34 and 35). In addition the larvae of some European and North American and of an Oriental species of *Trox* have been described.

The two larvae at hand of *T. procerus* Harold were found by Mr. Noel

Hynes on 3rd June, 1945, eating eggs of *Schistocerca gregaria* (Forskål) at Wardere, Somalia. Adults (fig. 1) reared from similar larvae, fed on locust eggs, were identified by Mr. G. J. Arrow at the British Museum (Natural History) as *Trox procerus* Harold.

Characters of Lamellicornia

The larva of *Trox* is a typical chafer-larva and is recognizable as such by the following characters:

Body with pale, soft integument, subcylindrical, the hind end normally curved downwards, always rounded at tip and without any terminal processes. Head well sclerotized with the mouth parts pointing downwards (i.e. head hypognathous), the upper part with a long median suture. The mandibles with basal part of cutting edge developed as a large coarsely and unevenly toothed and sculptured molar. Maxillae with two lobes, which may be fused into one, but which are always falciform, i.e. more or less curved towards median line of body and pointed at apex. Legs well developed, consisting of not more than four segments and in addition a single claw.

Characters of Scarabaeidae.

Among the three families of Lamellicornia the following characters assign to the *Trox* larva a place in the Scarabaeidae:

The combination of a mainly longitudinal (dorso-ventral) anal cleft with legs devoid of stridulating organs. No delimited oval cushion-shaped area on either side of the anal cleft. Antennae more than two-segmented. Mandible with a large condylus-like crushing tubercle on ventral surface of base, the free convex part of the tubercle turned towards the median line of the body. Third pair of legs more or less well developed.

Characters of Laparosticti.

Both adult and larval Scarabaeidae fall into two sections, the *Trox*-larvae belonging to Laparosticti according to the following characters:

Penultimate antennal segment with an inconspicuous sensorial appendage on inner part of apical articulating membrane. Inner and outer lobes of maxillae entirely free, i.e. neither fused with each other nor tightly fitting into each other.

Characters of *Trox*.

Within the Laparosticti the genus *Trox* can in the larval stage be recognized by the combination of three-segmented antennae (the sensorial appendage therefore on the second segment), with three well-developed convex dorsal folds on each abdominal segment. Anal lobes swollen. Distinct stridulating organs absent both from the mouth parts (where other groups have an inconspicuous asperate area on the ventral surface of the mandible and a rather conspicuous oblique row of teeth on the dorsal surface of the maxillary stipes extending from outer basal part towards the cleft that divides the two maxillary lobes[1]) and from the legs (where many Geotrupinae have a row of tubercles on the anterior surface of the hind trochanter and a striate area on the posterior surface of the mid coxae and *Phaeochrous* on the anterior surface of the mid tibiotarsus and mid femur and the hind surface of the fore femora). Each of the three transverse dorsal folds of the abdominal segments (except for those on the last few segments) with a practically simple row of short spine-like setae, which are inserted at the end of a small sclerotized ridge. Anal

[1] Both *Trox scaber* L. and *T. procerus* Harold have some tiny scale-like teeth in a homologous position, which must no doubt be considered as a beginning of the formation of a stridulating organ. The outer lobe is distinctly two-segmented in both species, the basal segment being much shorter.

cleft Y-shaped, a dorsal and two ventro-lateral anal lobes being present. Third pair of legs slightly longer than the others. Labrum anteriorly broadly bi-lobed, the two lobes separated by a shallow excision, the margin smooth. The general appearance is somewhat that of a cockchafer larva, but the head is rather smaller, and the hind end is distinctly tapered.

Characters of *Trox procerus* Harold (fig. 2).

As *procerus* is one of the largest species in the genus, the full-grown larva can be distinguished from most other species by its size, the specimens at hand being about 30 mm. long in a moderately contracted condition with a head-width of 5·5 and 5·7 mm. The larva of the S. American *T. suberosus* attains about 18 mm. length and a head-width of about 3·8 mm., whilst in the British *T. scaber* L. specimens in a similar condition are about 8 mm. long with a head-width of up to 2 mm.

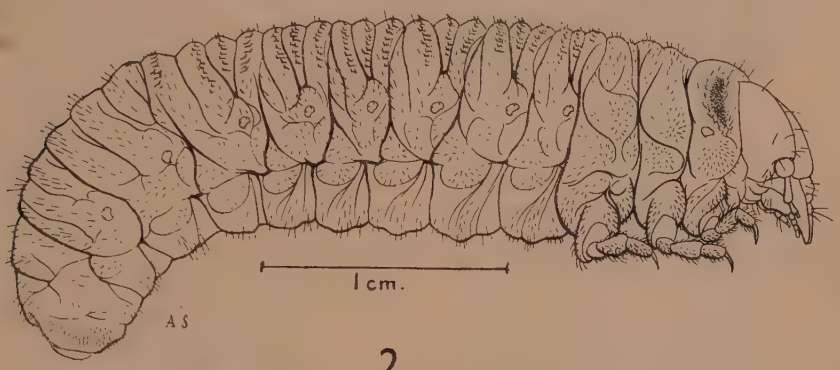
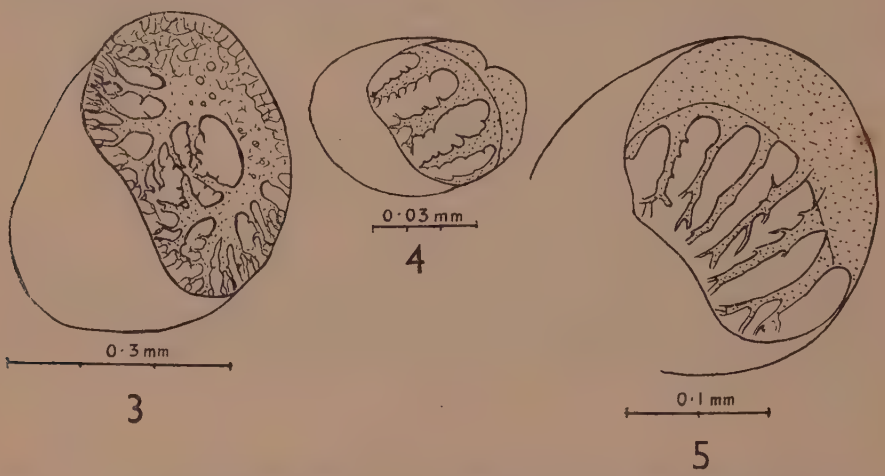


Fig. 2.—Full-grown larva, 3·3 times magnified.

In comparison with *T. scaber* the following characters of *T. procerus* seem to be of specific importance:

Head with rather dense reticulate rugosities, without any deep foveate punctures, but with some shallow impressions: a slightly transverse one on the parietalia close to the middle of the frontal suture, a longitudinal one on either side of median line on frontale, a half-elliptical one on hind part of frontale, the anterior end of which impression is bent outwards so as to join the slightly transverse impression on the parietalia, and a small shallow roundish impression at the 3 setiferous pores on lateral anterior part of frontale; the sculpture of the anterior half of the frontale somewhat rougher than that of the posterior part. First antennal segment almost twice as long as second, third shorter than basal diameter of second. Mandible distinctly longer than wide, dorso-lateral margin evenly moderately convex (in *scaber* strongly bulging outwards towards base and therefore strongly constricted just before base). Dorsal surface of maxillary stipes with a row of fine skin-asperities on apical half of inner margin of sclerotized part (vestige of stridulatory teeth ?); first segment of maxillary palpi only slightly shorter than each of the other two and more than twice as long as palpiger. Body with numerous setulose hairs; these are present on each of the three dorsal folds of the abdominal segments in addition to the spine-like setae, some of these setulose hairs somewhat longer, but there is no distinct row of long setae on any of the folds of each segment; all three folds of the seventh segment without spine-like setae; some of the setae on the seventh to ninth segments considerably longer. Ventrites with numerous setae, which form a continuous band on the anterior

fold of each segment, but are broadly interrupted in middle on the posterior fold, these bands consisting of 2–4 irregular rows of setae, which on the eighth and ninth segments only are reduced to one irregular row with a few adjacent small setulae. Lateral callosities with numerous hairs on each of the three parts on each segment. Tenth segment with stiff pointed short setulae interspersed with longer ones in about 6–10 irregular rows all round. In all these characters, except the vestigial stridulatory teeth, *T. procerus* differs from *scaber*, but in most of them it tallies apparently with *suberosus*, which has, however, apparently the first antennal segment shorter. Spiracular plates with two richly ramified main struts, thus appearing triforous (fig. 3) (in *scaber*—fig. 4—there are three main struts, which define between them two larger and outwards on either side a smaller opening, so that under low magnification the spiracles appear to be biforous).



FIGS. 3–5.— (3) *Trox procerus* Harold, larva; left spiracle of first abdominal segment. (Leitz eye-piece 4, objective 3.) (4) *Trox scaber* L., larva; right spiracle of second abdominal segment. (Leitz eye-piece 4, objective 6.) (5) *Trox costatus* Wied., larva; left spiracle of first abdominal segment. (Leitz eye-piece 0, objective 6.) (The structure of the spiracular plate itself is not shown in the drawings, a slightly lower plane having been brought into focus in order to figure the struts.)

Trox costatus.

T. costatus Wied., of which three specimens from the Batu Caves, Selangor, are in the British Museum (Natural History), is very similar to *procerus* in most of these characters, but it is only 13–18 mm. long with a head-width of 3·4 mm. The transverse impression behind the middle of the frontal suture is indistinct; the impression on the frontale on either side of the median line is subcircular; the first segment of the maxillary palpi though twice as long as the palpiger is less than two-thirds the length of the second segment; the first fold of the anterior five abdominal segments without longer setae among the spine-like short ones; on the other folds and segments the long setae differ very conspicuously from the setulose hairs, ventral setae long and arranged in a single row on the anterior fold and in an almost single broadly interrupted one on the posterior fold; tenth segment with only 3–4 rows of shorter and longer setulose hairs. The spiracles (fig. 5) have about half a dozen not much ramified struts, so that there appear to be about seven slit-like openings.

The author's thanks are due to Dr. B. P. Uvarov for making the specimens available to him and for supplying the funds for the two full-size illustrations, and to Mr. Arthur Smith for executing them so successfully.

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ERRATA.

P. 35, title, for "SCYMAENIDAE" read "SCYDMAENIDAE."
P. 49, line 11, for "*Ann. Mag. nat. History.*, (11) **9**" read "*Ann. Mag. nat. Hist.*, (11) **11.**"
P. 53, line 27, for "Dalle Tarre" read "Dalla Tarre."

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